GEANT Description of the Material in the Inner Tracker

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GEANT Description of Passive Material

- Main goals
  - multiple scattering treatment for track fitting
    - position and amount of material
    - X0
  - energy loss correction
    - amount of material (integrated along trajectory)
    - A, Z
- Description
  - geometry + material (atomic composition)
  - based on technical drawings, spreadsheet, pictures (!)
  - documented in note 5825
  - feedback is more than welcome !

Status

- A few numbers
  - ~4500 physical volumes
  - ~20 new material/compounds definitions
  - 64 kg of material
    - mostly in the tracking acceptance
    - actual weight: 120 kg (including outside tracker acceptance)

- Global amount of material checked in data
  - conversions (early study): OK to 15-20%
  - J/Ψ mass (recently): same level of agreement

Latest improvements (1)

- Trying to recover the 15% missing:
    - no large pieces obviously missing
    - must be a combined effect of many little pieces
    - the ISL description is known to be less complete and accurate
- New pieces added:
    - ISL
        - carbon-fiber support rails
        - insulation layer
        - carbon fiber rods over layer 6C
        - spool piece
        - connector on hybrid
        - longitudinal cooling pipes (partial)

Latest improvements (2)

- New pieces added (cont'd):
    - SVX
        - carbon fiber support rails
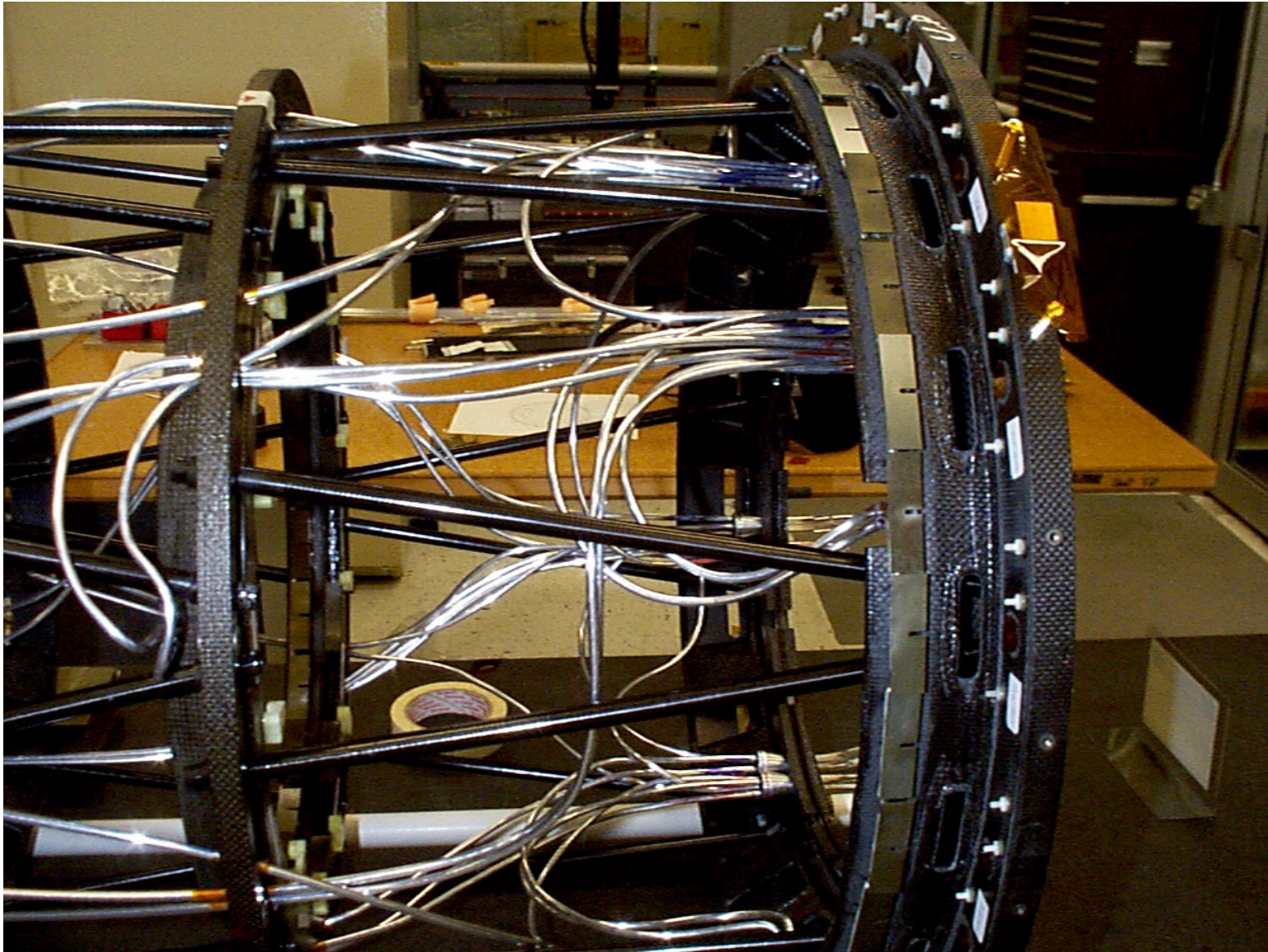   - HDIs
        - "5%" carbon fiber blocks

ISL rods and cooling

rods
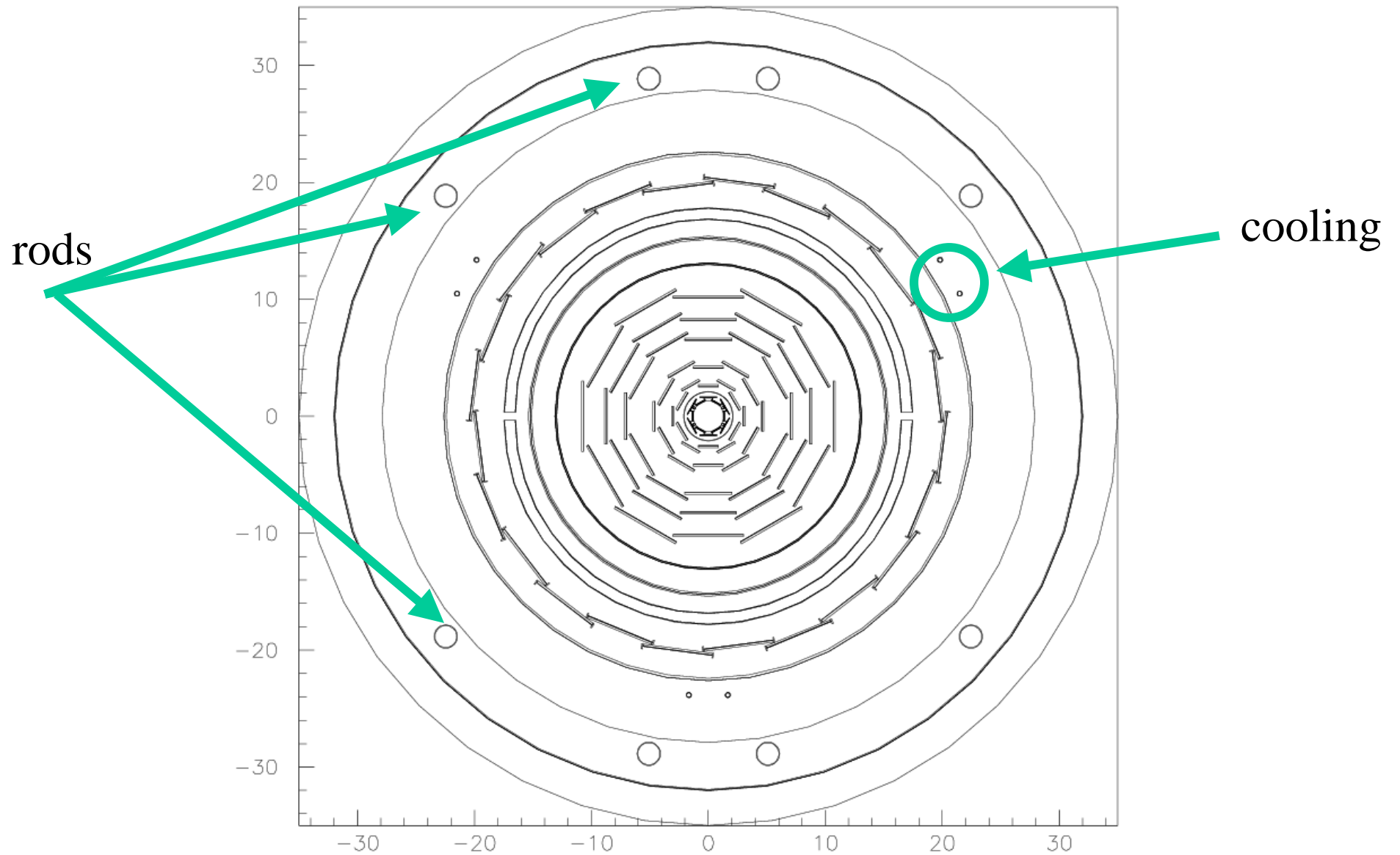
cooling

ISL cooling: difficult to model !

SVX support rails for ladders

rails

SVX: "5%" blocks

SVX: HDIs

portcard sections
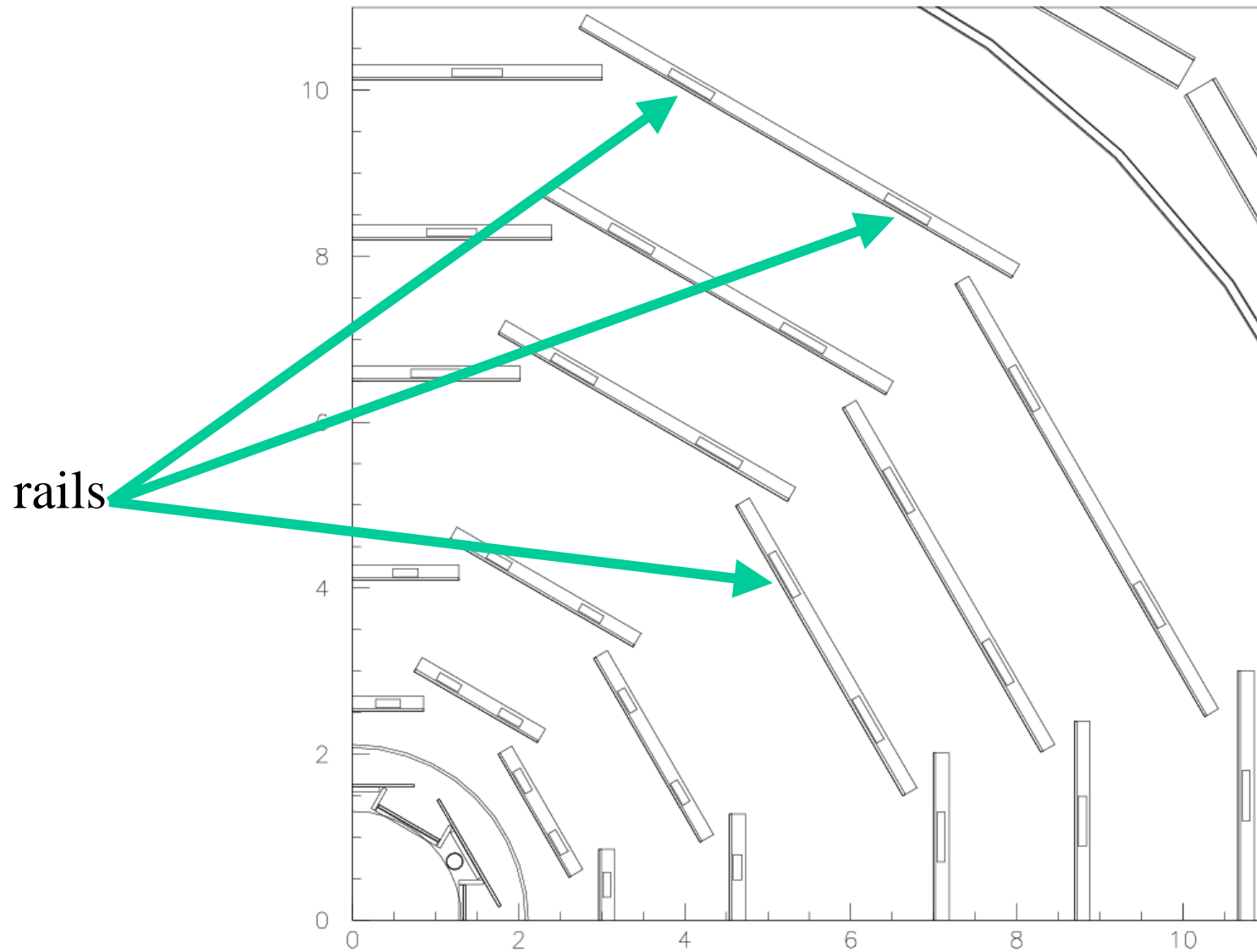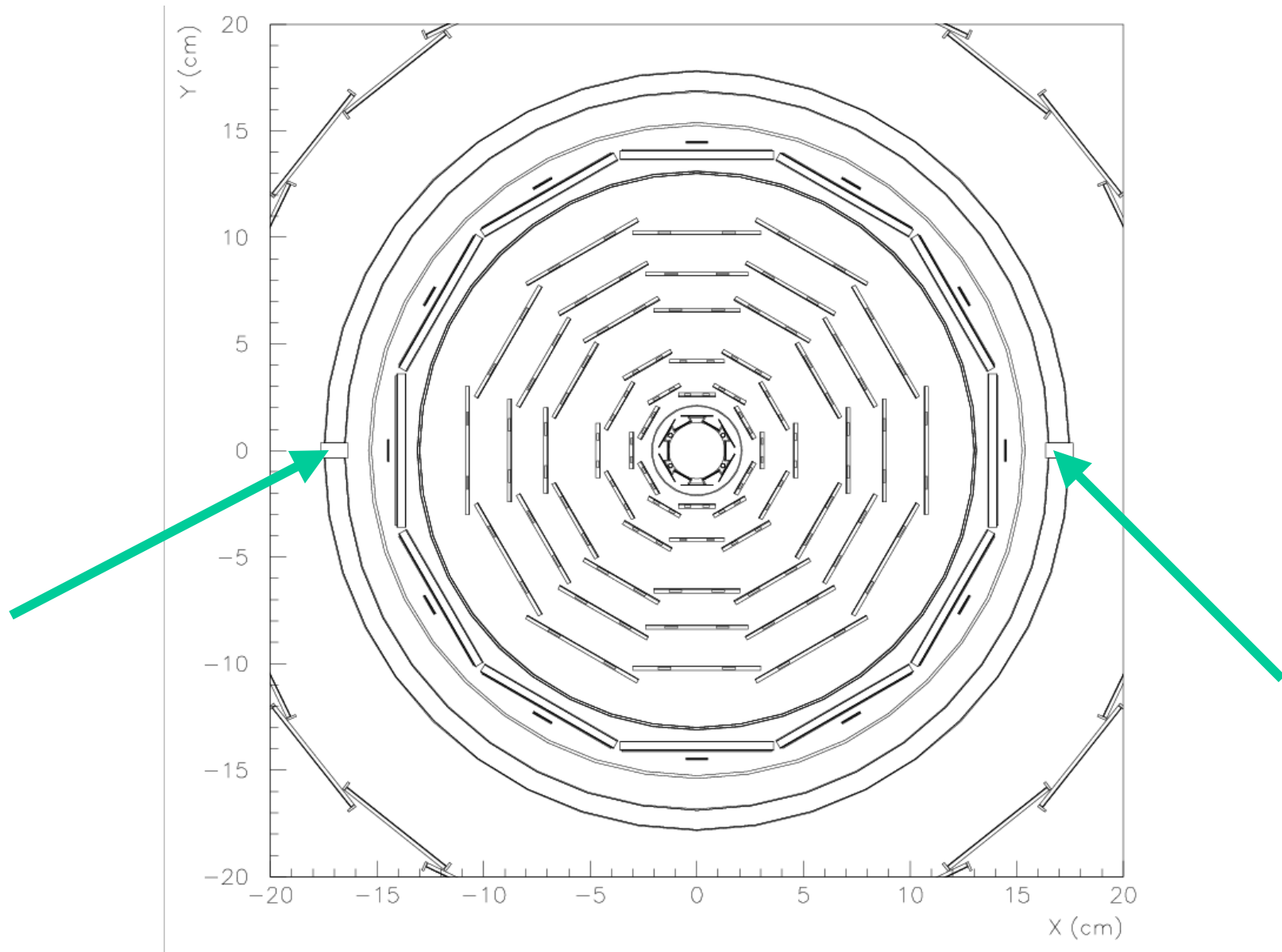
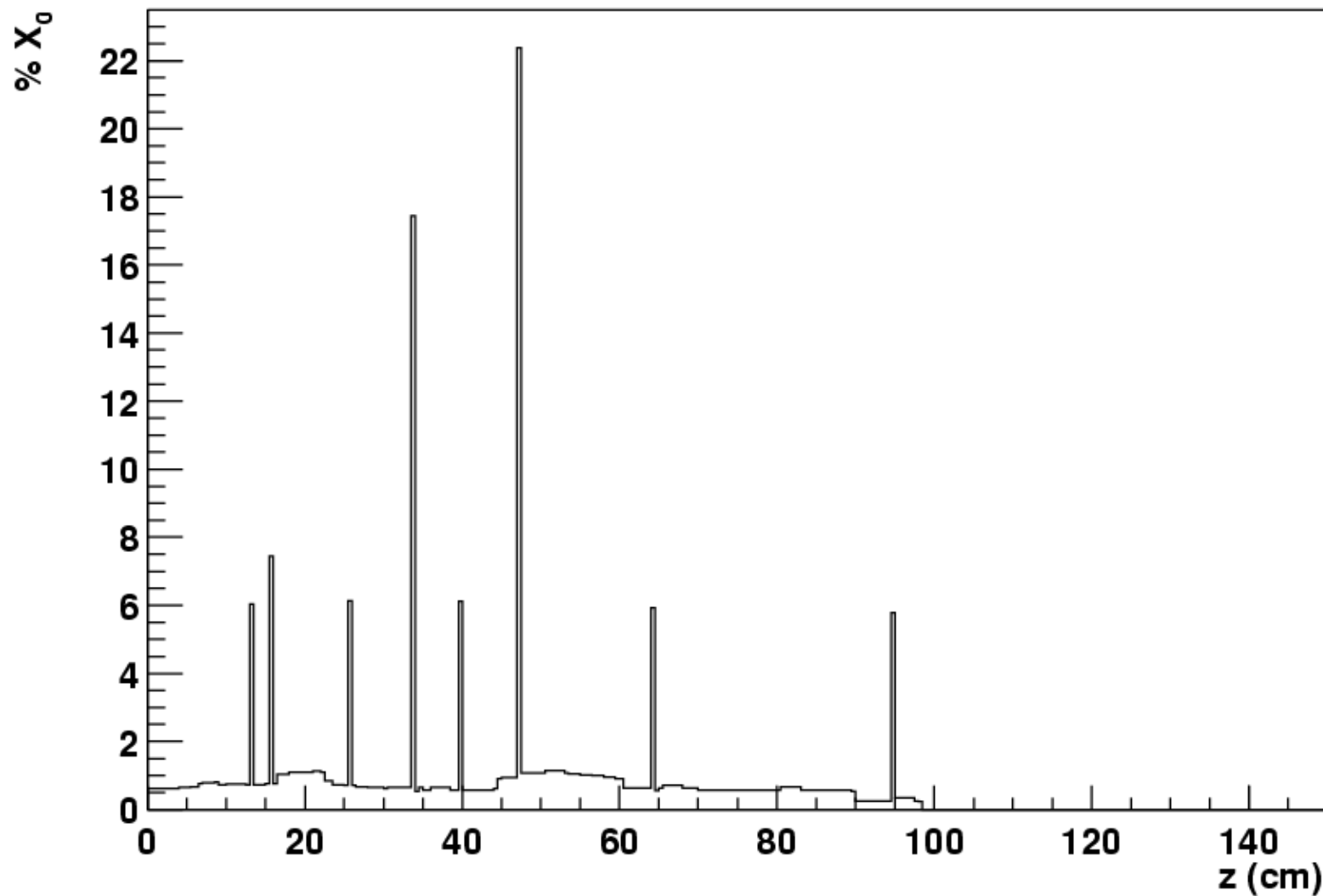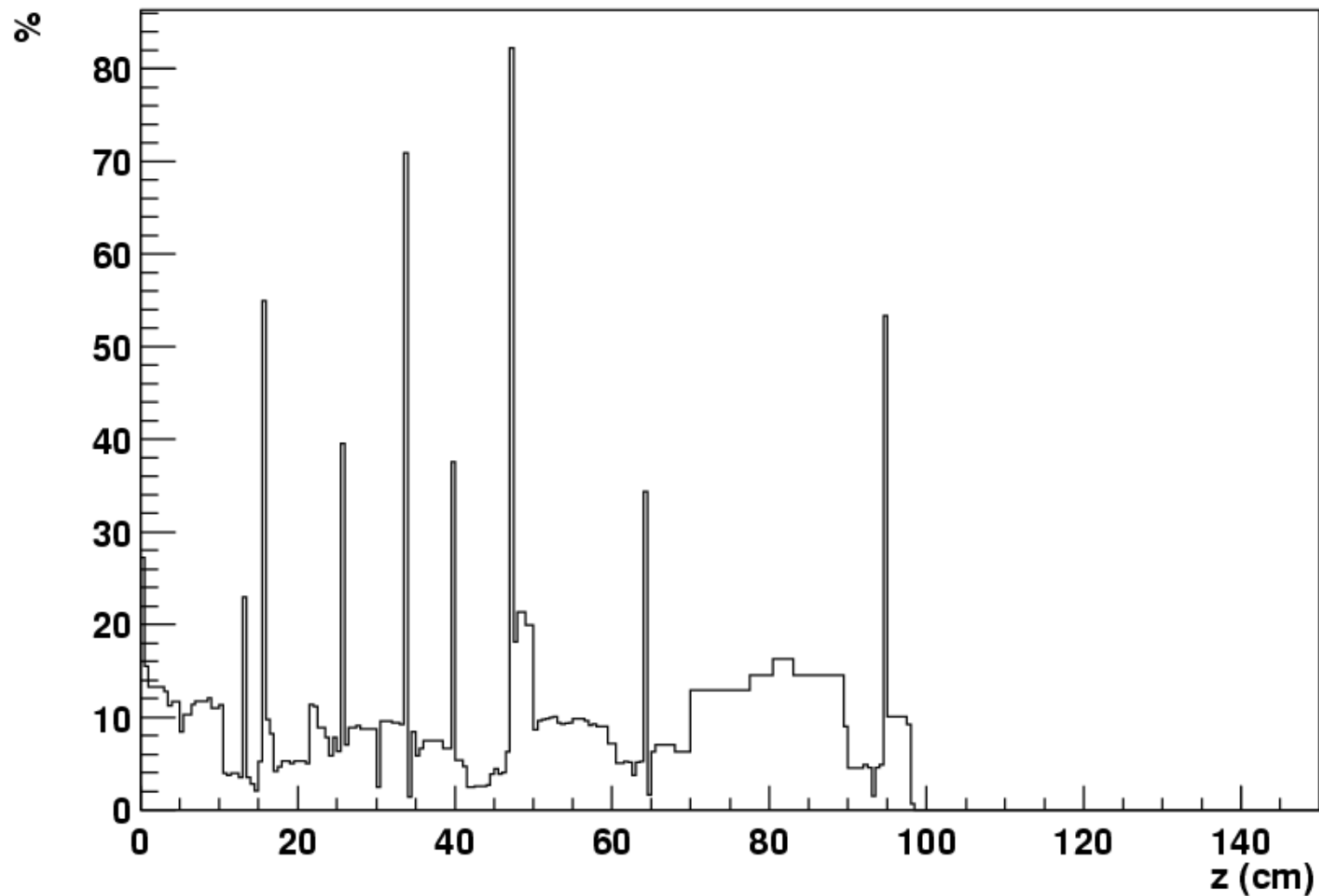vertical sections
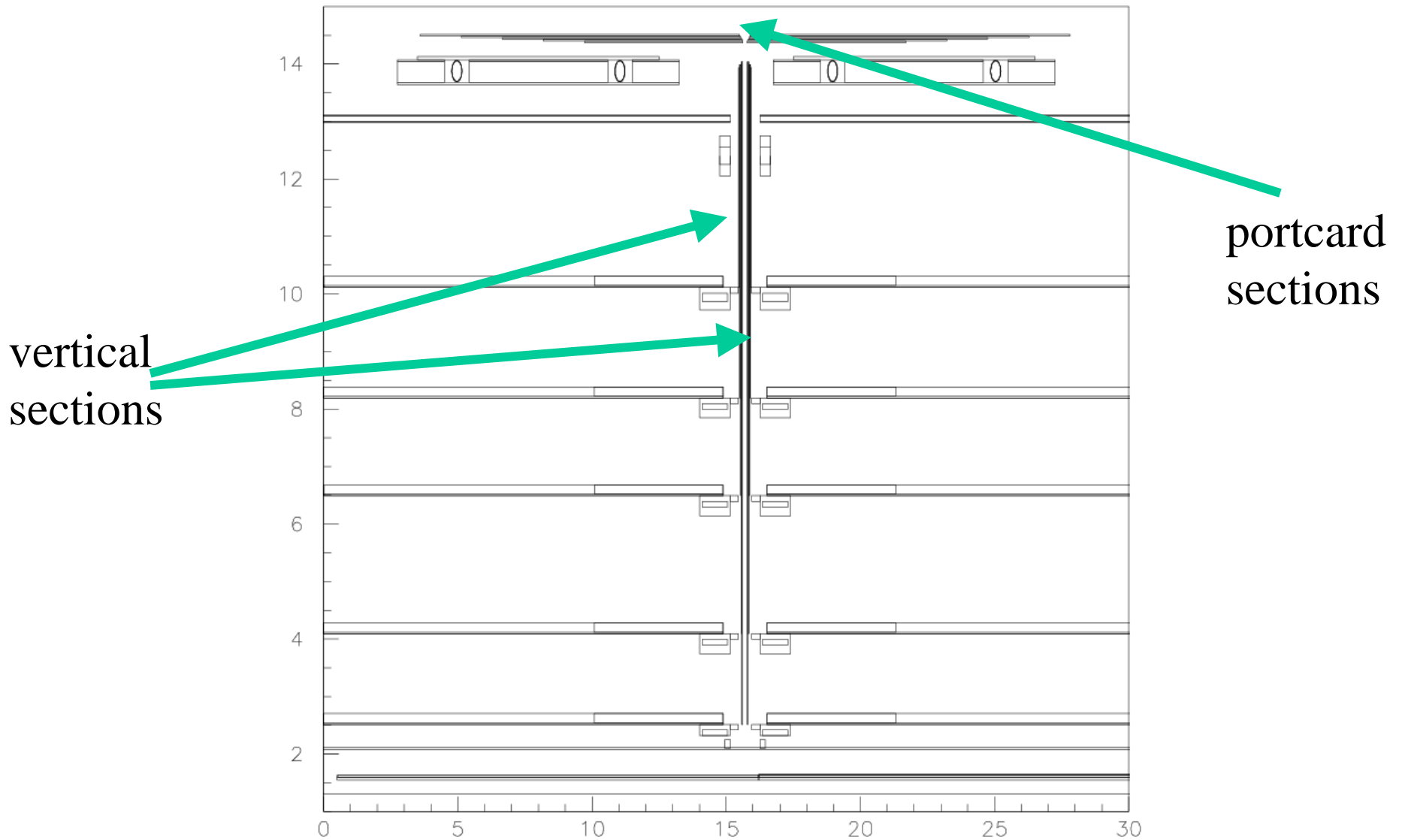
SVX: HDIs
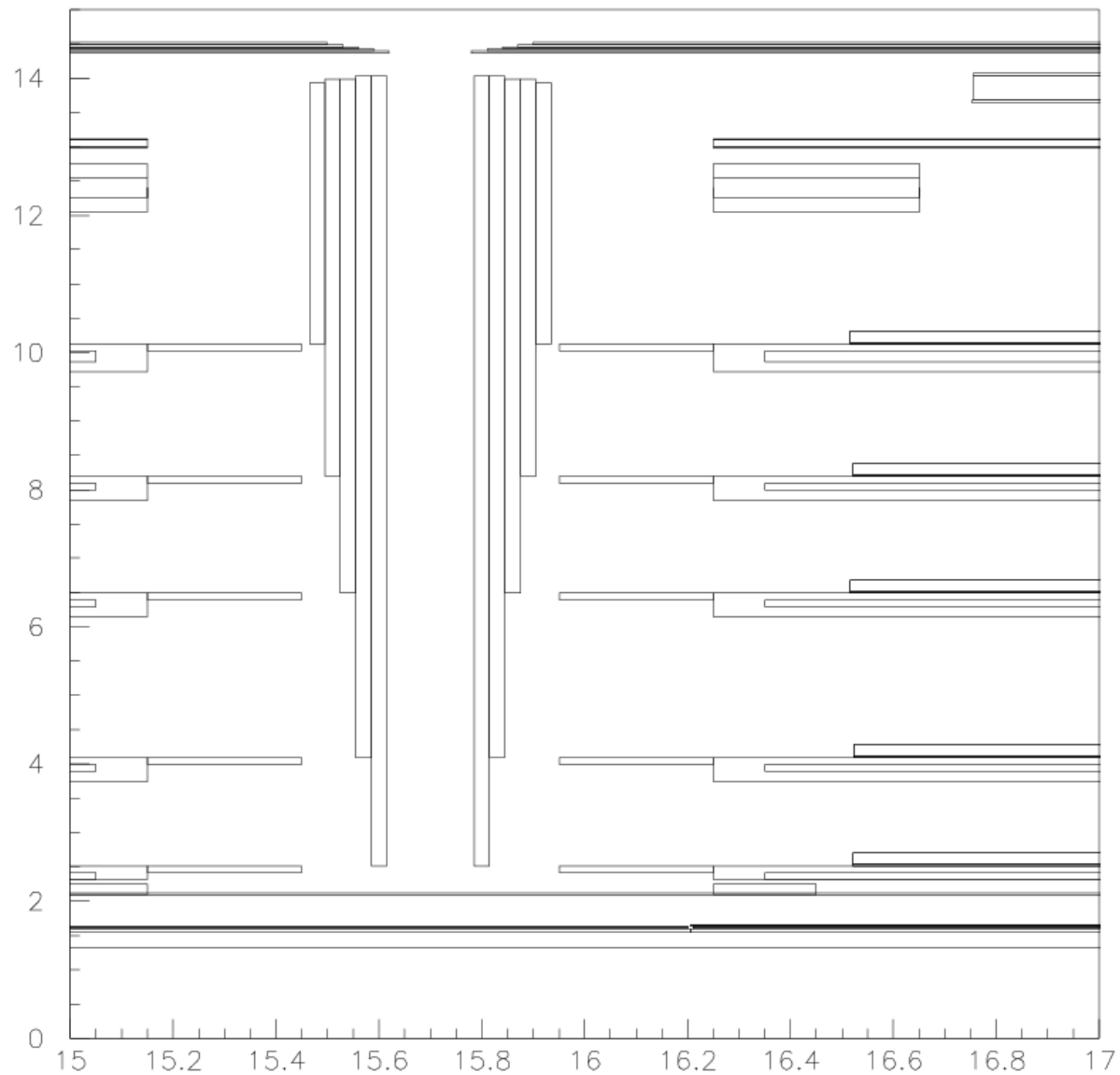
Relatively small absolute gain
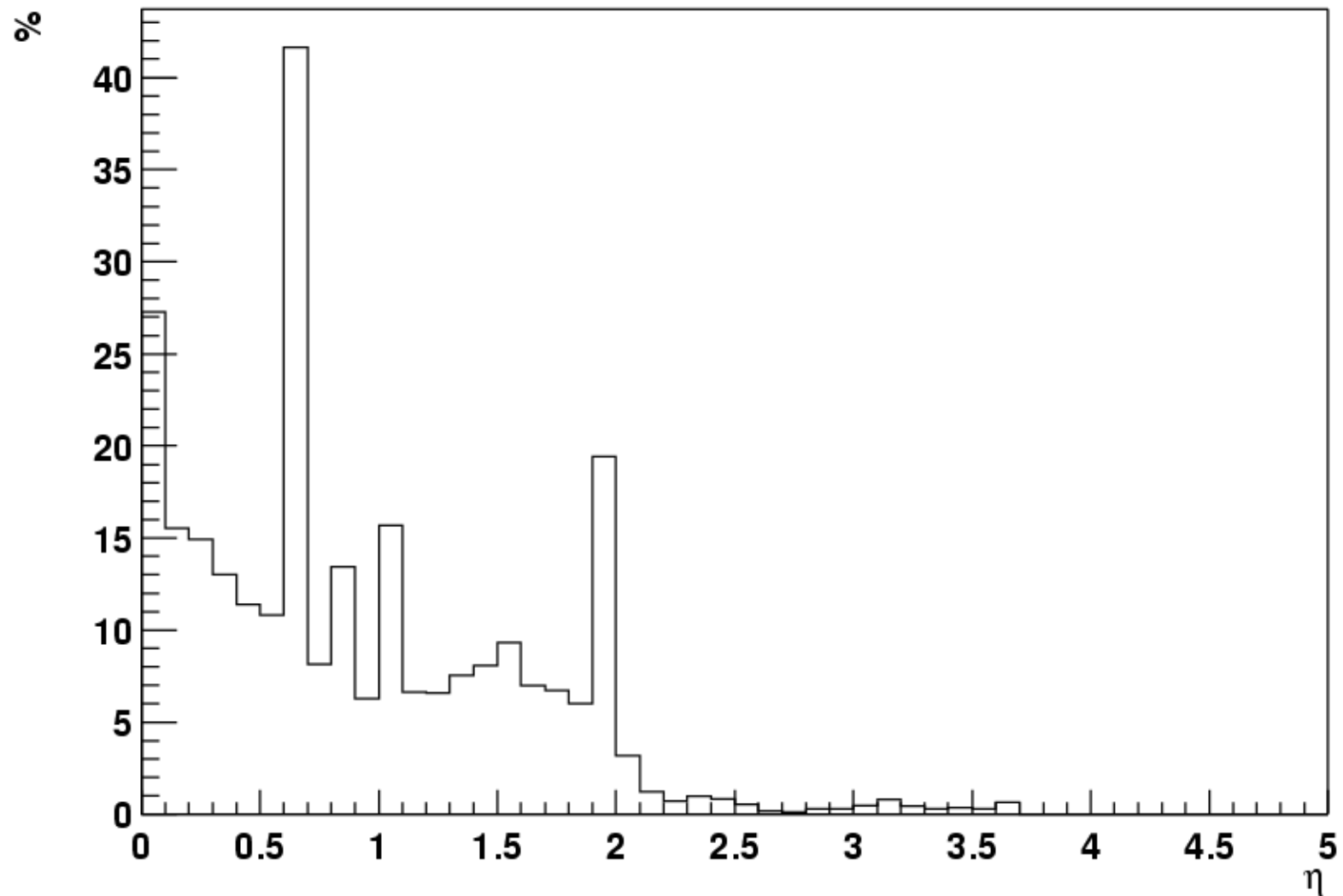

ALL all φ (absolute difference)

however not negligible in relative

ALL all ϕ (relative difference)

Relative increase in X_0 vs η

ALL all ϕ (relative difference)

Summary

- Recent improvements in description
    - gain in weight: 8 kg (72 kg total)
    - 50% of the estimated material seems to be recovered
    - to be checked by the J/ψ folks

- Plan for the description
    - very little hope to add the missing parts:
        - lack of documentation, drawings
        - difficult to model
        - the description is already too complex:
            - very difficult to debug and check for volume overlaps
            - large impact of CPU time for simulation

Plan

- Tuning of the description with data
    - photon conversions
    - comparison with single photons shot in the description
    - 50% of data already reprocessed
    - generation of MC sample on-going

- Normalization issues
    - the bad news: X_0 of COT can not well known
    - try to use silicon of ISL layer 6:   300 +/- 15 μm
    - eventually use the COT wires (long run)